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DISCLOSURE OF THE INVENTION

To achieve the objective, an optical control device in accordance with the present invention includes

a first substrate with at least one light output layer;

a second substrate with a light transmitting function, positioned opposite to the first substrate; and

a liquid crystal sandwiched between the first and second substrates,

one of the first and second substrates having electrodes for applying multiple scan signals, one of the first and second substrates having electrodes for applying multiple signal voltages,

wherein:

the light output layer is arranged in stripes and extends in the same direction as the electrodes for applying scan signals;

the first substrate has thereon a layer with a light polarizing function; and

the first substrate, the light output layer, the layer with a light polarizing function, the liquid crystal, and the second substrate are arranged in this order.

Generally, a display is produced in accordance with a scan signal, and the scan timings vary from one

electrode to another for applying scan signals. In contrast, according to the arrangement above in accordance with the present invention, the light output layer is arranged in stripes and extends in the same direction as the electrodes for applying scan signals. Therefore, the optical control device in accordance with the present invention can scan the light output layer for every scan timing, that is, the device can vary the light emitting timing for each light output layer corresponding to an electrode for applying scan signals, thereby achieving an impulse-type display. Further, the integration of the light output layer allows for a reduced overall thickness.

Further, through emission of different wavelengths, for example, R, G, and B light, for each light output layer arranged in stripes, a color display can be produced with no color filters. Hence, light transmission efficiency does not decrease due to use of color filters, and power consumption is reduced.

As mentioned above, an optical control device in accordance with the present invention allows for reductions in thickness, weight, and power consumption. Further, the impulse-type display allows for less blurred edges and persistent images when producing animation, thereby improving image quality.

Another optical control device in accordance with the present invention includes:

a first substrate with at least one light output layer;

a second substrate with a light transmitting function, positioned opposite to the first substrate; and

a liquid crystal sandwiched between the first and second substrates,

one of the first and second substrates having multiple active elements, one of the first and second substrates having gate electrodes for applying multiple scan signals, one of the first and second substrates having source electrodes for applying multiple signal voltages,

wherein:

the light output layer is arranged in stripes and extends in the same direction as the gate electrodes; and

the first substrate, the light output layer, the liquid crystal, and the second substrate are arranged in this order.

According to the arrangement above, the light output layer is arranged in stripes and extends in the same direction as the gate electrodes for applying scan signals. Therefore, the optical control device in accordance with the present invention can scan the light

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output layer for every scan timing. That is, the device can vary the light emitting timing for each light output layer corresponding to a gate electrode for applying scan signals, thereby achieving an impulse-type display using an active drive optical control device. Further, the integration of the light output layer allows for a reduced overall thickness.

Further, through emission of different wavelengths, for example, R, G, and B light, for each light output

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function, positioned opposite to the first substrate; and  
a liquid crystal sandwiched between the first and  
second substrates,

one of the first and second substrates having  
electrodes for applying multiple scan signals, one of the  
first and second substrates having electrodes for  
applying multiple signal voltages,

wherein:

the light output layer is arranged in stripes and  
extends in the same direction as the electrodes for  
applying scan signals;

the first substrate has thereon a layer with a light  
polarizing function; and

the first substrate, the light output layer, the  
layer with a light polarizing function, the liquid  
crystal, and the second substrate are arranged in this  
order.

Generally, a display is produced in accordance with  
a scan signal, and the scan timings vary from one  
electrode to another for applying scan signals. In  
contrast, according to the arrangement above in  
accordance with the present invention, the light output  
layer is arranged in stripes and extends in the same  
direction as the electrodes for applying scan signals.  
Therefore, the optical control device in accordance with

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the present invention can scan the light output layer for every scan timing, that is, the device can vary the light emitting timing for each light output layer corresponding to an electrode for applying scan signals, thereby achieving an impulse-type display.

In addition, the integration of the light output

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having source electrodes for applying multiple signal voltages,

wherein:

the light output layer is arranged in stripes and extends in the same direction as the gate electrodes; and

the first substrate, the light output layer, the liquid crystal, and the second substrate are arranged in this order.

With the arrangement, the light output layer is arranged in stripes and extends in the same direction as the gate electrodes for applying scan signals. Therefore, the optical control device can scan the light output layer for every scan timing, that is, the device can vary the light emitting timing for each light output layer corresponding to a gate electrode for applying scan signals, thereby achieving an impulse-type display.

In addition, the integration of the light output layer allows for a reduced overall thickness.

Further, through emission of different wavelengths, for example, R, G, and B light, for each light output layer arranged in stripes, a color display can be produced with no color filters. Hence, light transmission efficiency does not decrease due to use of color filters, and power consumption is reduced.

As mentioned above, an optical control device in

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accordance with the present invention allows for reductions in thickness, weight, and power consumption. Further, the impulse-type display allows for less blurred

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duration of 5% to 70% of each display frame time.

Placing such limits on the duration of light emission by the light output layer enables high quality animation to be produced without blurred edges and persistent images with the properties of the impulse-type display well maintained, while keeping high display luminance.

Further, preferably, the light output layer emits light for a duration of 15% to 40% of each display frame time.

Placing further limits on the duration of light emission by the light output layer surely enables high quality animation to be produced without blurred edges and persistent images with the properties of the impulse-type display well maintained, while keeping high display luminance.

The foregoing method of driving an optical control device may be adapted so that: the light output layer shines when a specified time has elapsed after a set of scan signals are transmitted to scan lines and extinguishes before a succeeding set of scan signals are transmitted; the light output layer shines with a different wavelength from those of adjacent light output layers; and more than one adjacent light output layers that shine with mutually different wavelengths are caused

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to shine simultaneously.

According to the method, the light output layer can be scanned correspondingly to applied scan signals for each scan electrode, that is, the light output layer can shine in accordance with scan timings, thereby producing an impulse-type display and allows for reductions in the number of ICs required for use in control.

Another method of driving an optical control device in accordance with the present invention is preferably such that: the light output layer shines with a different wavelength from those of adjacent light output layers; and each light output layer is either red, green, or blue so that red, blue, and green repeat periodically.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art intended to be included within the scope of the following claims.

#### INDUSTRIAL APPLICABILITY

As mentioned above, according to the optical control

Claims:

1. (Amended) An optical control device, comprising:

    a first substrate with at least one light output layer;

    a second substrate with a light transmitting function, positioned opposite to the first substrate; and

    a liquid crystal sandwiched between the first and second substrates,

    one of the first and second substrates having electrodes for applying multiple scan signals, one of the first and second substrates having electrodes for applying multiple signal voltages,

    wherein:

    the light output layer is arranged in stripes and extends in the same direction as the electrodes for applying scan signals;

    the first substrate has thereon a layer with a light polarizing function; and

    the first substrate, the light output layer, the layer with a light polarizing function, the liquid crystal, and the second substrate are arranged in this order.

2. (Amended) An optical control device, comprising:

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a first substrate with at least one light output layer;

a second substrate with a light transmitting function, positioned opposite to the first substrate; and

a liquid crystal sandwiched between the first and second substrates,

one of the first and second substrates having multiple active elements, one of the first and second substrates having gate electrodes for applying multiple scan signals, one of the first and second substrates having source electrodes for applying multiple signal voltages,

wherein:

the light output layer is arranged in stripes and extends in the same direction as the gate electrodes; and

~~the first substrate, the light output layer, the liquid crystal, and the second substrate are arranged in this order.~~

3. The optical control device as defined in claim 2, wherein

the active elements are provided on the second substrate.

4. (Amended) The optical control device as defined in

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either one of claims 2 and 3, wherein

the first substrate has a layer with a light polarizing function.

5. The optical control device as defined in any one of claims 1 through 3, wherein:

the light output layer provided on the first substrate is formed by a light emitting layer composed of at least one of an organic EL light emitter, an inorganic

the light output layer shines for a duration of 15%  
to 40% of each display frame time.

13. (Cancelled)

14. (Amended) A method of driving an optical control  
device as defined in either one of claims 1 and 2,  
wherein:

the light output layer shines when a specified time  
has elapsed after a set of scan signals are transmitted  
to scan lines and extinguishes before a succeeding set of  
scan signals are transmitted;

the light output layer shines with a different  
wavelength from those of adjacent light output layers;  
and

more than one adjacent light output layers that  
shine with mutually different wavelengths are caused to  
shine simultaneously.

15. The method as defined in claim 14, wherein  
each light output layer is either red, green, or  
blue so that red, blue, and green repeat periodically.